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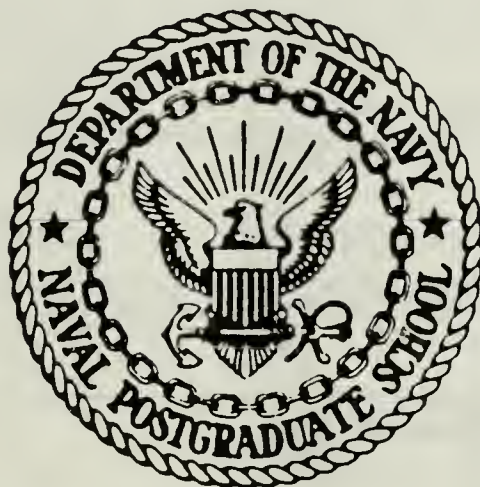
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THESIS

AN ASSESSMENT OF DEPARTMENT OF DEFENSE
QUALIFIED PRODUCTS LISTS

by

Robert Dale Vint

March 1987

Thesis Advisor:

P.M. Carrick

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Interview comments obtained from vendors and contractors dealing in the electronic business sector are compiled with their suggestions pertaining to the QPL process. The last chapter contains analyses of the previous studies contrasted to research conducted, recommendations for program improvement and conclusions.

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An Assessment of Department of Defense
Qualified Products Lists

by

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Lieutenant Commander, United States Navy
B.S., United States Naval Academy, 1974

Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

This thesis surveys the Qualified Products Lists (QPL) program. It provides an introduction to standardization and specification by giving their definitions and explaining their role in the government acquisition process. The Defense Standardization and Specification Program is briefly outlined to provide a framework of understanding of the context in which the QPL process works. The intended application of the prequalification process is covered along with a history of the QPL program. Summaries of two prior studies on the effectiveness of the QPL program are discussed. Included also is testimony from the Hearings before the Senate Committee on small business in 1984 concerning competition for parts procurement.

Interview comments obtained from vendors and contractors dealing in the electronic business sector are compiled with their suggestions pertaining to the QPL process. The last chapter contains analyses of the previous studies contrasted to research conducted, recommendations for program improvement and conclusions.

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I. INTRODUCTION TO QUALIFIED PRODUCTS LISTS

A. PURPOSE OF PAPER

There are many instructions, policies, regulations, and directives governing the federal acquisition process. A myriad of studies, research papers, theses, committee reports, and independent analyses have been conducted concerning the effectiveness of various aspects of this process. However, the Qualified Products List (QPL) program, currently under the cognizance of the Defense Standardization and Specification Program, has received relatively little research attention. Each federal agency maintains administrative control over its own QPLs. Until recently, there was no central administrative control over the entire federal program. Even now, there are no effective or visible management statistics to measure program benefits or determine a cost-effective analysis.

Investigation has revealed that only two studies have been conducted by the Department of Defense on the QPL program. The DOD is by far the largest user of QPLs. In each study problems were noted and recommendations made. However, no indication of follow-up was discovered. The QPL program has been, and continues to be, controversial. Small businesses claim the program is unfair by limiting competition and have brought their complaints to the Small

Business Administration and to Congress. Because of the attention the QPL program has received by Congress and the SBA, QPL directives have been updated and resources budgeted to better administer the program. But is the program effective in accomplishing its objectives?

In the last two years another area of QPL application has received much attention, the electronic sector of semiconductors. The industry is outpacing QPL procurement procedures. With the growing importance of integrated circuits in major defense systems, this nation should adopt business procedures that allow it to obtain the highest quality, most advanced electronic products. How can the QPL process achieve these objectives? This paper will explore these questions and provide some suggestions.

II. STANDARDS AND SPECIFICATIONS IN THE GOVERNMENT ACQUISITION PROCESS

A. INTRODUCTION

This chapter will provide an introduction to the purpose and importance of standards and specifications in the government acquisition process and give an understanding for the purpose of Qualified Products Lists (QPLs). Definitions of standards and specifications are given along with a brief history of their implementation in the government acquisition process. The Defense Standardization and Specification Program (DSSP) is also briefly outlined. QPLs will be introduced at the end of the chapter.

The acquisition process is the initial phase of the logistic support cycle in the Federal supply support establishment. This process has to be responsive to a myriad of requirements ranging from simple general hardware items such as nuts and bolts to complex and ambiguous research and development of human resource projects. For the acquisition process to fulfill its role in the logistic support cycle, requirements must be defined in such a way that a conceptualized need can be conveyed to potential buyers through a competitive process. An exact understanding of this requirement must be sufficiently conveyed so that a contractor can prepare estimates that can be fairly and equitably evaluated prior to an award of a contract. [Ref. 1:p. 2]

Standards and specifications are the current means used by the Federal Government, and more specifically the Department of Defense (DOD), to define these requirements. The DOD Index of Specifications and Standards (DoDISS) currently lists more than 45,000 active standardization documents prepared by DOD activities, other federal agencies, or industry groups. [REf. 2:p. 10]

B. DEFINITIONS

1. Specifications

Specifications are documents prepared specifically to support acquisition and cover items which vary in complexity from uniform chevrons to missile weapon systems. They establish requirements in terms of complete design details or in terms of performance, but in most cases in terms of both design and performance. Design specifications attempt to define the end item in terms of its physical characteristics. Generally they state precise measurements, tolerance, materials, production process, and finished product tests, quality control and inspection requirements. Performance-type specifications take on the form of a performance characteristic or a functional description. It expresses requirements in terms of functions to be performed such as degrees of precision, speed of operation, maintenance levels expected (e.g., mean time between failures), general tests and quality standards. Performance-type specifications are normally associated with more complex,

technologically advanced requirements. [Ref. 1:p. 3]
Specifications should establish requirements insofar as is practicable in terms of performance so that: 1) they do not restrict creativity in meeting specifications, 2) they permit solicitations of competitive bids from the largest segment of industry, and 3) they place greater responsibility on the contractor to achieve the performance required. Specifications may cover a single item such as a camera or millions of items such as bullets. To fulfill their purpose, specifications should be tailored for each application.

2. Standards

Standards are documents that establish engineering and technical requirements for processes, procedures, practices and methods that have been adopted as standard. Their purpose is to control variety. They may cover materials, features of items, engineering practices, definitions, nomenclature, test, inspection, packaging and preservation methods. Standards represent the best solution or preferred solution to recurring design, engineering and other logistic problems. Standards function in acquisition through specifications. They disclose or describe the technical feature of an item in terms of what it is and what it will do. In contrast, the specification for the same item describes it in terms of the more complex description of requirements for acquisition. Standards are referenced

in specifications for those design requirements which are essential to achieve the design objectives (i.e., interchangeability, compatibility, reliability, and maintainability). [Ref. 3:p. 3-2] Simply stated, standards specify item form, its physical shape, item fit, description of item's input/output characteristics, and item function.

As an example of the relationship between specifications and standards, a specification for spark plugs would reference the screw-thread standard and reach standard (operating temperature range), to insure optimal engine performance and interchangeability of spark plugs produced by different manufacturers. [Ref. 2:p. 5]

C. BACKGROUND

Standardization in the military departments has been an evolutionary process. World War I pointed out the need for standardization. The U.S. Armed Forces were repeatedly frustrated because of the differences in such matters as operating procedures, tactics, flight safety and aircraft design. In 1919 the Departments of War and Navy established a Joint Aeronautical Board to address these issues. This board could be considered a forerunner to a military specification and standardization program. [Ref. 4:p. 62] The Aeronautical Board was replaced by the Aeronautical Standards Group which in 1941 began publishing a Joint Army-Navy series of specifications and standards. In 1942 the Joint Army-Navy Specification Board was formed to provide

cooperation between the services in both procurement and standardization. This Board established procedures and format controls over the Joint Army-Navy series of specifications.

In February 1953 Public Law 436, the Cataloging and Standardization Act (codified title 10 U.S.C. Chapter 145-Section 2451-6), was translated into DOD Directive 4120.3. The Defense Standardization Program was established. The defense Supply Management Agency was then assigned management control. It established the military series of specifications and standards to replace the Joint Army-Navy series and all other series in use by the military departments. At this time, the use of military specifications was made mandatory for all acquisitions.

The basic DOD Direction 4120.3 has been revised many times to effect improved standardization management within the military series. During the 1960's revisions provided for coordination of the Defense Standardization Program with the General Services Administration, the Aeronautical Standards Group, and other government agencies and bureaus. A 1965 revision also provided for industry participation to avoid duplication of effort and to obtain the benefit of technological and managerial skill. Current DOD standardization and specification policies and operating procedures are published in the Defense Standardization Manual 4120.3M. It is the result of many years of development. Today the

Defense Standardization Program is the most diversified and largest standardization activity in the world. [Ref. 4:pp. 62-63]

Why has so much effort been made to more effectively manage standardization in government acquisitions and to increase its usage?

D. BENEFITS OF STANDARDIZATION

The primary purposes for applying standardization principles follow.

1. Standardization conserves resources. It reduces the unnecessary and inefficient proliferation of generally similar types, kinds, sizes, and styles of items, thus avoiding costs of specifying new items. Larger discounts can be realized by making larger purchases. Better prices may also be realized by the availability of additional competitive sources.
2. Standardization is a base upon which to certify. Standardization of parts, components and subassemblies reduces the risks associated with developing and producing new products and services. Standardized products have a historical record of usefulness, reliability and performance.
3. Standardization can provide a "stepping stone" for evolutionary improvements. It can promote technological growth by providing an accepted, reliable foundation for improvements and innovations.
4. Standardization simplifies. It conserves resources by minimizing and simplifying training, technical data, engineering and support requirements. Standard items significantly reduce expenditure of research, development, test and evaluation, and logistics support resources. The number of purchase orders and receiving inspections can be reduced as well as inventory and inventory carrying costs. [Ref. 2:p. 3]

Also intangible benefits are achieved, which include:

1. Standardization educates. They set forth quality goals or ideals, for the guidance of manufacturers and

users alike. They are invaluable to the manufacturer who wishes to enter a new field.

2. Standardization provides a common language between buyers and sellers. They improve quality control based on accepted and explicit specifications. [Ref. 5:p. ix]

Now that standards and specifications have been defined and their purposes and benefits covered, an overview of the Defense Standardization and Specification Program (DSSP) will be given. An introduction to the Qualified Products Lists (QPLs) follows.

E. DSSP

The DSSP is a decentralized program with overall DOD policy, guidance, and administration centered in the Office of the Assistant Secretary of Defense for Acquisition and Logistics (OASDA&L). Overall management of standardization policies, procedures, and guidance is the responsibility of the Director, Standardization and Acquisition Support, within OASDA&L. Daily operations are delegated to the Director, Defense Materiel Specifications and Standards Office (DMSSO). Within each service and the Defense Logistics Agency (DLA), a Departmental Standardization Office (DEPSO) has been established to manage those portions of the DSSP assigned to the respective Department and Agency.

Products used by the military are grouped into logical families, such as space vehicle components, flight instruments and land mines, and are identified as Federal

Supply Classes (FSCs). Management and engineering practices, such as reliability, safety, and configuration management, are identified as Standardization Areas. For each FSC and Standardization Area, a military organization known as an Assignee Activity (for FSCs) and Lead Service Activity (for Areas) is delegated the responsibility for analyzing, planning for, and insuring that optimal standardization is accomplished.

Development of the actual specifications, standards, and related documents is performed by DOD organizations known as Preparing Activities. It is the Preparing Activity's responsibility to develop, maintain, and coordinate individual DSSP documents, and to insure that they meet mission requirements. [Ref. 2:pp. 10-11] Procedures for preparing and coordinating the documents are outlined in DOD 4120.3M. Also, an organizational chart showing the relationship and responsibilities of standardization management is shown on page 4-24 DOD 4120.3M.

F. THE CONCEPT OF QPLS

Standards and specifications are an excellent means for conveying requirements to prospective sellers and buyers. However, during the 1920's as specifications became more complex, due to advances in technology and greater complexity in weapon systems, the time between creation of an item specification and delivery of completed item became greater and greater. Therefore, some time-critical requirements

experienced delays in being met. It was noted, first by the Navy, that the delays were basically caused by the testing requirements to insure that the item conformed to the specifications. A way was needed to make the procurement system more responsive to critical requirements. Out of that need was created the "Navy Qualified Products Lists." Its conceptualized purpose was to insure the procuring agency of timely delivery of products with reasonable assurance that they would be satisfactory for their intended use.

The process was designed to work in the following manner. The government agency (i.e., Navy) would first have to have an item requirement. That requirement had to be translated into a specification. The Navy would then announce to prospective contractors the need for qualified manufacturers of that item. The manufacturers would supply their own resources to build the item and test it under government supervision, with no guarantee of subsequent procurements of that item. Upon satisfactory completion of testing, that manufacturer would become "qualified" to produce that particular item. Then, whenever the government required that particular item, only the qualified manufacturers would be considered in the bidding for the contract. Because these qualified manufacturers had already proven themselves capable of producing the item, only minimal quality assurance inspections were considered necessary for subsequent procurements.

As the other military departments began qualifying some of their procurements, conditions for qualification testing were established by the DOD. The directive stated that a qualification requirement may be included in a specification when one or more of the following conditions existed:

1. The time required for testing in connection with production would unduly delay delivery of the supplies being purchased;
2. The tests would require special equipment not commonly available;
3. The costs of repetitive testing would be excessive; or
4. The interest of the Government requires assurance, prior to award, that the product is satisfactory for its intended use. [Ref. 6:p. 4]

The QPL program was designed to save time in the procurement of products and provide some assurance of proper operation in use.

G. SUMMARY

This chapter has covered standards and specifications to lay the foundation for an understanding of the government acquisition process and the premises for the creation of the QPL program. This foundation is considered necessary to fully understand and appreciate the problems and recommendations that will be brought up throughout the course of this paper.

Today the qualification program is a viable alternative in the acquisition of products. The program has continuously changed over the years, as problems have surfaced and

recommendations have been made. There are now approximately 1200 QPLs families with the most active sector being electronics. As with all programs, QPLs are only as effective as their application. Observations on the qualification program and its current application in the high-tech electronics sector will be covered in Chapter IV. But first, the history of QPLs will be discussed along with various DOD reports done on the past effectiveness of the program.

III. HISTORY OF THE QPL

A. INTRODUCTION

This chapter will provide a brief history of Qualified Products Lists (QPLs). Current Department of Defense directives will be cited which govern the policies and procedures of QPLs. The definition of QPLs, its purpose and intent will be stated. Two Department of Defense (DOD) studies have been conducted concerning the effectiveness of the QPL program. First a 1968 study will be discussed, and its main findings and recommendations for improvement of the program will be summarized. In 1979 a second study of the QPL program was conducted by the Defense Materiel Specifications and Standards Office. That study's findings and recommendations will also be summarized. As brought out in these studies, a major criticism of the QPL program was that QPLs restricted competition for government procurements. That debate peaked during Senate hearings before the Committee on Small Business in April of 1984. Specific arguments brought up at the hearings, both for and against QPLs, will also be covered. Recommendations mentioned at the hearings for improvement of the program will also be summarized. A summary and conclusions drawn from the studies and hearings will complete the chapter.

B. BACKGROUND

In the late 1920's a decision rendered by the Comptroller General of the United States, permitted the Navy to establish a list of approved materials for use in procurement of military items. Otherwise, delivery could be delayed while testing was conducted to ensure conformance with performance specifications. [Ref. 6:p. 2] This list was called the "Navy Acceptable List of Approved Materials" and was later changed to the "Navy Qualified Products List." Following World War II, the Army, Navy and Air Force established a joint list known as the "Military Qualification Products List," to be used in connection with military procurements. The policies and procedures applied to the Military and Federal Qualified Products Lists are based on the same Comptroller General decisions as the original Navy Acceptable List. The present statutory authority for Qualified Products Lists is found in the U.S. code 2452.

C. QUALIFICATION DIRECTIVES

Pursuant to this Act, authority to establish, publish, review and revise Qualified Products Lists was delegated to the military departments. Specific provisions for the conditions under which QPLs may be issued were included in the Armed Services Procurement Regulations (ASPR), now titled Federal Acquisition Regulations (FAR). General information, procedures, format and provisions governing the qualification process were delineated in Defense

Standardization Manual M200, now titled Defense Standardization Manual, DOD 4120.3-M, "Defense Standardization and Specification Program." Amplifying information on the QPL program is found in Provisions Governing Qualification (Qualified Products Lists) SD-6, "Defense Standardization and Specification Program."

D. DEFINITION OF QUALIFICATION

Qualification is defined as, "the entire process by which products of manufacturers or distributors are examined and tested in accordance with requirements specified in a federal or military specification and then identified on a Qualified Products Lists." [Ref. 7:p. 1] A QPL is then a list of products designated in their specifications that must be manufactured by a qualified company prior to government procurement. Each qualified product or part lists the names and addresses of manufacturers qualified to produce it.

E. PURPOSE OF QUALIFICATION

The specification is the only medium for establishing a requirement for qualification. Since most specifications are based on performance requirements, the possible variations in design, quality and the nature of products are such that it is deemed impractical to procure them solely on conformance tests without unduly delaying delivery. For some items, simple non-destructive conformance tests do not

exist. The purpose of qualification therefore, is to provide for long, complex or expensive evaluations and tests prior to, and independent of, any acquisition, and thus eliminate delivery delay. Qualification is also intended to reduce unit product costs and to improve readiness through assured continuous availability of designated products. To ensure quality, reliability, and safety of specific products or families of products, destructive qualification tests are required prior to the opening of bids or the award of negotiated contracts. [Ref. 7:p. 1] Testing of a product for compliance with the requirements of a specification in advance of, and independent of any specific procurement action, is identified as qualification testing in the specification. Products that successfully pass the required tests are included on a QPL appropriately identified and related to the pertinent specification. Preparing activities identified in the specification are responsible for qualification. To establish a QPL an approved and dated military or federal specification or non-government standard must exist which requires qualification and sets forth the qualification examination, tests and criteria for retention.

F. REQUIREMENTS FOR QUALIFICATION

Approval for justification of qualification is granted by the departmental standardization office and the Defense Product Standards Office (DPSO), when one or more of the following conditions exist:

1. The time required to conduct one or more of the examinations and tests to determine compliance with all the technical requirements of the specification will exceed 30 days and would unduly delay delivery of the products being purchased. Use of this justification should advance product acceptance by at least 30 days.
2. Quality conformance inspection would require special equipment not commonly available.
3. Qualification covers life survival or emergency life-saving equipment (see FAR 9.304b).
4. The application is critical; failure of the part or equipment would jeopardize successful completion of the mission or pose a significant risk to life or property. [Ref. 3:p. 4-3]

Prior to inclusion of qualification in a specification, the preparing activity shall determine that:

1. There is no other practicable way of obtaining conclusive evidence of the availability of products meeting the requirements of the specification in a reasonable time, prior to, and independent of, acquisition.
2. Two or more sources are available and willing to submit their products for qualification.
3. Test facilities and resources are available to establish and maintain the QPL adequately and without delay.
4. The estimated cost of testing and evaluation has been developed. [Ref. 3:p. 4-4]

When qualification is determined to be required, it shall be included as a specification requirement at the time of initial document promulgation.

When instituted, the qualification process was intended for use on a selected basis and only when the requirement could be justified. However, by 1965 the qualification process was applied in approximately 1,561 general and subsidiary specifications, 5% of the existing federal and

military specifications. And the percentage of specifications requiring prequalification was increasing. This growing number of QPLs, coupled with criticism of the program by government contractors, indicated possible misunderstanding by military departments of the role of qualification in government procurements. This possible misunderstanding of the role of qualification could naturally lead to misuse of the program in government procurements.

G. THE 1968 DOD STUDY OF QPLS

1. Introduction

In 1965 the Assistant Secretary of Defense for Installations and Logistics directed that an in-depth study be undertaken to ascertain the reasons for the increase of QPLs and to determine the following:

- a. Are Qualified Products Lists, in fact, necessary?
- b. If so, are they required to the extent of current coverage?
- c. Are the current criteria governing QPLs meaningful and realistic?
- d. What changes are necessary to more effectively operate and control the qualification process? [Ref. 6:p. 4]

2. Findings

The Departments of the Army, Navy and Air Force were directed to submit responses on specifications ranging in age from as much as 18 years to those issued within the past six months. It was revealed that a substantial number of

QPLs were issued many years following publication of the specification. The policy at that time called for the cancellation or revision of a specification where a QPL had not been established after one year more than the minimum period of time estimated for actual examination and testing. In some cases specifications were as much as ten years old before a QPL was issued. This indicated qualification was not always successful in eliminating delay in delivery of products. Of the total specifications submitted, 695 had no products qualified to them. There were 747 QPLs for which only one producer was qualified. The military departments indicated that on 55 documents, qualification had been waived at least once. At least 65 specifications required 100% duplication of qualification tests during product delivery inspections. Relative to the justification for imposing qualification in a general specification, 62.2% of the documents cited time required to conduct compliance testing would unduly delay delivery of the products being purchased. However, there appeared to be no pattern for reviewing justifications. The statistics compiled for this study showed there was no indication that time is in fact being saved by imposing qualification requirements in the specification. [Ref. 6:p. 5]

A small group of specifications, within a 10-20 year age group, maintained QPLs containing anywhere from 20 to more than 100 different qualified products, and from just as

many qualified sources. This raised the question as to whether the product in question had not stabilized to a point where it is a common item or material, available from anyone within the given industry. The elimination of qualification in these cases should have been considered.

Additional observations and questions were brought out by the 1968 study. On many specifications, the military departments maintained that they need assurance of quality prior to contract award so as to guarantee safety in flight. But what guarantee is inherent in a product that has been produced one time by a given manufacturer? Does this qualified product assure quality in production? Obviously the answer is no. Quality if controlled only by appropriate measures and examination taken and made during production and it is the good specification that assures this quality through its requirements and conformance testing. It was concluded that the then current criteria for justification of qualification requirements be reconsidered. The study determined that the time required for testing in connection with production would unduly delay delivery of the supplies being purchased and the costs of repetitive testing would be excessive, were the only real justification for specifications to contain qualification requirements.

The findings of the study raised the question why were there 747 specifications wherein the QPL contained one product, available from one source? It was determined there

must be many other reasons why additional producers have not chosen to qualify their products or upgrade their products to meet the requirements of the specification. Questions were raised. Is one manufacturer being favored because he exceeds all others and the extra advantage of a second source is really not necessary? Is testing prescribed in such a manner that to comply, producers would be priced out of the market? Do others maintain that their reputation is such that their products will be bought and used by government prime contractors irrespective of whether they have qualified? The study felt these questions should be explored as well as QPLs with no producers for a reasonable period after issuance, must be questioned.

The 55 documents wherein the departments indicated granting of waivers to qualification requirements, raised the question as to the reason for the waivers, the validity of the requirements, and the need for qualification in the specification. It appeared a qualification requirement should be questioned if waiver becomes necessary.

During the 1968 study, associations representing a cross-section of American industry were asked to submit comments and suggestions relative to qualification approval and the administration of the process. Industry associations in general agreed that the qualification process has a place in military specifications. The following is a summary of their 1966-1967 comments:

- a. Qualification has merit where products are relatively new and for which little experience has been established.
- b. In some cases QPLs are over twenty years old identifying products now obsolete and no longer required.
- c. The time lapsed between approval of a specification and issuance of the QPL is too lengthy.
- d. Identification of the QPL to specific revision of the specification is lacking.
- e. QPLs do not reflect up-to-date and available products in all cases and time limits for review of, and/or requalification of products is not adhered to or is lacking.
- f. Many non-critical items require qualification, a decided waste of effort and money.
- g. Test date and detailed test description is not readily available to potential users.
- h. Once a product is qualified and placed on the QPL, the process of removal for good cause is difficult, almost impossible.
- i. The QPL serves as a useful buyer's guide to products that have been qualified once to a published specification.
- j. Retain the qualification process and strengthen the policies and procedures that govern it.
- k. Standardize among the departments relative to the number of qualification reports required of a vendor.

These comments represented a cross-section of industry associations as expressed by both users and manufacturers of products contained in QPLs. [Ref. 6:p. 7]

As the comments indicate, manufacturers were essentially using the QPL as a buyer's guide. However, to attain a degree of quality assurance, some contractors relied on

pre-testing and source inspection for the selection of a vendor. As stipulated in DOD 4120.3M,

inclusion of a product on the QPL, . . . does not in any way relieve the original equipment manufacturer (OEM) of his contractual obligations to ensure that delivered products (including the qualified products used in the equipment) comply with all specification requirements.

Implicit in the comments is that many OEMs maintain their own data on vendors products, applied their own testing programs in order to fulfill their contractual obligations.

OEM's maintained that there is a need to know where on the manufacturing experience curve a given vendor qualified his product. In critical applications, where reliability is an important factor, this becomes extremely important in determining appropriate rescreening procedures. At that time the government was obligated to protect the information received from manufacturers unless permitted to do otherwise. The study recommended that this policy be reevaluated.

Some vendors agreed that qualification requirements are necessary and that the process is the fundamental cornerstone of an efficient procurement management system. Implied in these comments is the reasoning that the QPLs are the means by which "garage operations, profiteers, disreputable producers, and the like" are kept from government business. However, this reasoning was never intended as a justification for qualification and is embodied in other federal acquisition regulations. [Ref. 6:p. 9]

3. Recommendations

The study concluded that the qualification process is a legitimate procurement technique, but recommended the following:

- a. All military departments should review specifications containing qualification requirements to ensure conformance with current criteria, policies and procedures. The elimination of QPLs or the revision of QPL requirements would be appropriate, wherein it has been revealed that:
 - (1) qualification tests are identical to conformance tests (test confirming delivered products conformance to specifications),
 - (2) production lead time is at least twice that of qualification test time,
 - (3) no products are qualified to the specification and the document is in force for one year more than the minimum period of time estimated for actual testing, and
 - (4) qualification has been waived at least once in the past year.
- b. DOD should coordinate the following with a goal towards changing current practices and a strengthening of the qualification process:
 - (1) The only criteria for justifying qualification should be the time required for testing in connection with production would otherwise unduly delay delivery of the supplies being purchased and the costs of repetitive testing would be excessive.
 - (2) Rewrite Chapter IV of the Defense Standardization Manual to reflect 1. above and place the following requisite on qualifying activities:
 - (a) provide for requalification requirements in all documents calling for qualification on a periodic basis,
 - (b) provide evidence of requalification on published QPL,

- (c) expedite publication of QPL after issuance of specification,
- (d) provide enforced criteria for removal of deficient suppliers from the QPL,
- (e) provide an accelerated communication system with QPL users in identification of all additions, changes and removals,
- (f) establish periodic time limits for reviewing qualification justification,
- (g) establish periodic time limits for reviewing QPLs with a view toward elimination,
- (h) establish procedures that provide specification managers with waiver information, and
- (i) consider means for making qualification data available to prospective users. [Ref. 6:p. 11]

The preceding recommendations were intended to give more meaning to the qualification process and provide a more efficient means of administering the program.

H. THE 1980 DOD STUDY OF QPLS

1. Background

In July 1979, the Director of the Defense Material Specifications and Standards Office tasked its staff engineer, A. Douglas Reeves, with examining DOD's policies and procedures governing the establishment and use of QPLs. The exact nature of events leading to this study is not known. However, the scope was intended to be broad, i.e., does the DOD have a need for QPLs? The study utilized readily available information and statistics. Surveys and data gathering exercises were intentionally avoided. The

report was intended to be a catalyst to allow concerned parties the opportunity to refute conclusions and recommendations and provide appropriate data. After receipt and evaluation of comments, a final course of action was to be defined and pursued. The following seven paragraphs contain findings with noted weaknesses of the then current operation of the QPL program with appropriate recommendations made by Reeves in his preliminary report.

2. Findings

The then current management of QPLs was, in many area, not as strong as it should have been. Good documentation on the need for existing QPLs was lacking. Periodic review requirements should be strengthened. Statistics were typically not available at various levels of management as to numbers of QPLs with zero or one source. Reeves felt visibility and attention needed to be provided to QPLs in each commodity class on a continuing basis. One mechanism which could play a strong role in this regard is the Federal Stock Class program analysis. Reeves suggested that this annual report could document the need for QPLs in the class and provide effective management statistics on the qualification program. Examples are: statistics as to the number of QPLs in each commodity area, ratios of specifications with QPLs versus those without, identification of QPLs with zero or one source and the length of time the situation has existed. Also the currency of QPLs and estimates of

acquisition activity should be determined. The class assignee activity would be assuming a management function with regard to QPLs. [Ref. 8:p. 4]

During the late 1970s few new QPLs were being approved in the Defense Standardization Program. However, products could be added to existing QPLs without the same levels of approval. As a result, many new products were added to "general type specification" QPLs while the number of QPLs did not increase. Strong documentation and approval rules were recently mandated when a QPL was prepared, but the same degree of scrutiny, extensive evaluation, and justification did not apply to perpetuation of a QPL. Reeves felt that the requirement for qualification to be reviewed at intervals not greater than two years is necessary and should be thorough. Greater definition, controls, and visibility should be provided to the discipline of qualification when it is applied. Reeves recommended that the DOD should initiate an intense program to review qualification procedures in each commodity area. Detailed justification should be developed for all existing QPLs. Many should be cancelled. Specifications which require QPLs should be justified as absolutely necessary. [Ref. 8:p. 14]

Some QPLs existed with vendors who had not been retested in ten years. Many QPLs existed with zero or one source, while others were not being actively procured.

These needed to be reviewed, updated or cancelled, especially those involving items not being repetitively procured. Reeves also perceived a reluctance to cancel QPLs due to expected pressure from those who had borne the expense of qualification and could expect to find their competition increased. This problem needed to be addressed.

[Ref. 8:p. 15]

Reeves found that DOD QPL policies and system operations varied as to intensity of QPL management depending on the item in question and the government personnel involved. Resource problems caused many of the limitations and difficulties in the operation of the present system. QPLs should only be established and maintained when adequate resources are available to provide necessary updates, manufacturer recertifications, and proper program management. New QPLs should be published at specific intervals with dates of latest manufacturer requalification.

Reeves discovered that under the then current program, if a general specification required qualification, all items covered by a detailed specification also have qualification associated with them. Reeves believed that qualification procedures should be used only for high usage items and not as a requirement on lower usage items, i.e., items not procured in large quantities. Detailed rules for qualification should be developed for each commodity area. Market conditions, item criticality, item characteristics,

and testing requirements vary sufficiently to warrant different system structures and control techniques.

It had been argued that by mandating the use of QPLs a contractor is forced to utilize quality components. But Reeves stated that perhaps the most important constraint for the contractor for the overall system being produced comes through environmental/life testing conducted as part of the system demonstration. This would seem to be a forcing function insuring that contractors do what is necessary to control product quality and specification compliance by their suppliers. System contractors, where they represent predominant QPL users, should have the opportunity to provide strong inputs into both the nature of QPLs and their individual justification. [Ref. 8:p. 15]

Reeves commented that QPLs can limit competition and can be expected to increase acquisition costs. The expense of qualification can be significant and, since no guarantee of obtaining a contract and amortizing these costs exists, can have a negative effect on the potential number of suppliers. This can be particularly troublesome in a limited source or sellers market. This was determined to be another factor a preparing activity should consider in determining the need for a QPL. Increased participation by the government in sharing the costs of testing in this situation when a QPL is deemed necessary, may be desirable.

3. Conclusions of the 1980 DOD Study

The actual significance and integrity of a QPL is a function of the many factors comprising the detailed operation of the system, such as the time allowed to elapse between recertification, degree of enforcement, and the relationships between tested units and delivered production units. Over the range of commodity items covered by QPLs, there is a great variation. Implicit in the program is the idea that QPLs assume functions in the Quality Assurance arena. Where that may be appropriate, program features, such as enforcement techniques, comprehensive feedback mechanisms, and auditing and testing requirements should be structured to allow a strong, positive reliance on items procured from QPL sources. Inherent in the program should be continuing monitoring features to assure and demonstrate cost effectiveness of these additional quality assurance techniques.

Difficulty in developing qualified sources was identified as a problem for low volume item specifications. Reeves suggested these problems would best be handled by not requiring qualification for low volume items. Qualification, in such instances, was not an appropriate acquisition technique. Particular difficulty existed in trying to rationalize the mandatory nature of QPLs as applied to the cumbersome process of obtaining waivers and trying to justify qualified products with zero or one qualified source. First

article inspection and other methods of assuring necessary demonstration of requirements would allow better flexibility in matching costs and risks. The specification preparer needs to be more actively involved in the actual acquisition environment. He should have a keen appreciation of the acquisition situation (number of acquisitions, quantities, costs, percentage contractor versus direct government acquisitions and unique acquisition problems). Proper feedback mechanisms between the procuring activity and the specification preparing activity should be developed.

4. Final Recommendation of the 1980 DOD Study

The 1980 report suggested that the criteria for establishing QPLs should be expanded. QPLs are justifiable only when they enhance product quality, reduce acquisition risks, or avoid otherwise excessive costs or delays in procurement. If the government could afford complete verification of all specification requirements, including qualification testing, in all acquisition situations, the need for qualification procedures would be moot. However, some trade-offs in quality, risk, and cost must, on occasion, be made.

The 1980 report suggested that the set of circumstances which should prompt consideration of establishing a QPL should be as follows:

- a. An item is procured repetitively.
- b. The unit dollar value of the items is relatively low.

- c. Some relatively complex/expensive tests are required to demonstrate compliance with specification requirements.
- d. Demonstration of compliance with qualification requirements is not critical in terms of mission or safety.

When these conditions do not exist, a QPL would not generally be warranted. If qualification is intended to include quality assurance functions, criterion c. can be replaced or supplemented by the following: "extensive supplier control and inspections are necessary to demonstrate compliance with specification requirements." [Ref. 8:p. 16]

Could QPLs be eliminated? In an absolute sense, Reeves stated, the answer was yes. Other techniques are available which could be substituted in QPLs were eliminated. Pre-award surveys which verify contractors' technical capabilities, first article testing, and variations of these approaches could fill the void created in QPLs were eliminated entirely, although not without cost or risk ramifications. However, Reeves felt that the qualification process should be retained as an option for inclusion in specifications. The philosophy of QPLs has a legitimate basis predicated on the complex acquisition environment in which it is used. There are both apparent and real contradictions in and limitations to the way the DOD uses QPLs; but the basic concept has application. They should be used only when other techniques would result in unsuitable

risks or costs and when benefits commensurate with costs can be demonstrated. Increased use of QPLs should not be encouraged. References to "intangible benefits" of the QPL system was made on occasion. These "benefits" will be discussed later.

5. Summary of the 1980 DOD Study

Reeves felt a comprehensive review, assessment, and development of alternative QPL policies and procedures in selected commodity areas should be initiated. Service groups, with interaction with affected industry segments, should be convened for this function. Qualification is a legitimate acquisition option. The process is, however, misapplied and could be improved. Lack of program intensity, as a result of inadequate resources, resulted in many of the problems discussed. When the report was published, Reeves believed that the recommendations would stimulate discussion, result in a redefinition of objectives, generate momentum for change, and ultimately strengthen the program.

I. SENATE HEARINGS BEFORE THE COMMITTEE ON SMALL BUSINESS

1. Background

A recent event has affected the QPL program. This was the Hearings before the Committee on Small Business of the United States Senate held on April 6 and April 12, 1984, discussing the Small Business Competition Enhancement Act of 1984. The majority of the testimony concerned the need for

greater government effort toward promoting the open competition of small business in the federal procurement of spare parts. During the course of proceedings the QPL program was repeatedly mentioned. A summary of the main points of discussion and opinions follow.

The bill had two main goals. The first goal was to increase small business participation in the federal procurement process, thereby reducing costly noncompetitive procurements. The second was to broaden our nation's industrial base for civilian and defense procurements. The bill would require the procuring agency to:

- a. justify in writing the need for prequalification,
- b. formalize and make known the standards required to prequalify,
- c. provide opportunities for those desiring to qualify, and
- d. provide test and evaluation services at no cost to a small business when insufficient qualified suppliers are available. All failures to qualify would be reported back to the business concern with justification.

Free testing and evaluation services for small businesses, where additional sources are deemed necessary, was designed to lower product cost, expand industrial base, and allow entry of newer products with higher quality. Also at issue was the extent to which procuring agencies should be allowed to use prequalification of sources as a procurement technique.

The testimony given can be broken down into three general areas: testimony was given by individuals in favor of the QPL program, those individuals wanting the program eliminated, and those individuals seeing the program as having value, but needing changes. Proponents of the QPL program stated,

The use of QPLs . . . serves an extremely important purpose. There are many parts and components of weapons, ships, and aircraft systems that are not only critical to the proper operation of these systems, but also critical to the safety of their crews and operators. Maintaining a list of prequalified products is one way of assuring only acceptable items will be considered. [Ref. 9:p. 75]

J. Brosnan of the National Security and International Affairs Division of the U.S. General Accounting Office stated, "QPLs are needed . . . problems lie in the abuse of the system." [Ref. 9:p. 181] W. Adams Jr. from the National Security Industrial Association commented, ". . . we believe that there is a valid need for prequalification requirements under specific circumstances as determined by government agencies, especially the Department of Defense." [Ref. 9:p. 394] S. Evans, Assistant Administrator for Procurement at NASA, pointed out, "There are often market situations where only a few firms may possess the resources and technical expertise to manufacturer items that meet the exacting needs of the space environment." [Ref. 9:p. 222] Qualified products 'S' lists or space lists, are commonly issued by NASA. The concentrated support for QPLs came from the Electronics Industries

Association Components Group. H.J. Rowe, representing the group, stated,

The (proposed) restrictions on qualification or prequalification . . . are of concern to us in that we see a strong potential for lowering the quality of the products and systems that comprise our industrial mobilization base. . . . Qualification is so important for electronic components that a domestic and world-wide system has been developed for commercial and industrial components. It is essential for electronic systems that performance and reliability is verified. [Ref. 9:p. 231

He felt that a history of reliability and quality has been established through the combined efforts of industry and government procuring agencies. The specifications and standards so derived represent the culmination of years of effort to provide a quality product at minimum cost to the government. Even one opponent of the program, R. Ludwig, speaking on behalf of the National Federation of Independent Business, admitted, "there are some times when you must have a qualified manufacturer make a part, I think that falls more rightly into electronic components, for example, where a component has to do something other than just be there."

During the testimony the most vocal opponent of the QPLs was B. Hahn, Manager of Government Affairs with the National Tooling and Machining Association. He was for elimination of the current QPL program for the following reasons:

- a. The program has evolved to the point where its main function is to prevent competitive procurements. Hahn stated that of the 3.9 million parts in DOD's spare parts inventory, only 7%, or approximately 275,000, are procured through open competition. Most of the remaining 93%, or approximately 3,625,000 parts,

require bidder and/or product prequalification before a new source's bid will be considered. Some of the many thousands of "critical" items on these parts lists are floor wax, automotive grease, filing cabinets, shipboard loudspeakers, lightbulbs, and spark plugs.

- b. Prequalification is used as a means to deprive small business concerns of their statutory right to have SBA make the final determination of their capability to perform under its certificate of competency program. Normally the SBA has the final determination on whether a small business concern has the capability to produce quality products in sufficient quantities for specific government acquisitions, however, no business concerns can bid for prequalification products if they are not first qualified.
- c. Prime contractors (OEMs) make the decision whether a component should be prequalified, thus restricting suppliers.
- d. Quality control cannot be achieved through prequalification. Other quality control techniques are far more effective and should be utilized.
- e. DOD's specification data storage and retrieval capabilities are close to nonexistent. Without knowledge of the standards required to qualify, prospective competitors are locked out. B. Hahn supported this reason with the following example:

A group of NTMA members and staff were invited to Tinker AFB, reputedly one of their more efficient procurement activities, last year by Air Force Secretary Verne Orr. A very large portion of the spare parts procured there fall into one of these five categories:

- (1) We have the data, but it's been reproduced so many times that it has become illegible so we have to buy sole source.
- (2) We don't have the data and we don't know where it is so we have to buy sole source.
- (3) We have the data and it is complete, but we don't know whether it's proprietary because we destroyed the original contract which tells us which data we own so we have to buy it sole source.

- (4) We have part of the data and it's legible. If we can ever find the missing pages, maybe we can stop buying sole source.
- (5) The data is marked proprietary and since we do not have the qualified personnel to review proprietary claims, we assume that it must be proprietary so we have to buy the part sole source. [Ref. 9:p. 420]

Other comments brought up at the hearings criticizing the system included: it creates "astronomical" administrative expenses to the small businessman with no assurance/indication of potential return on his investment. QPLs have been used to favor "friends" or to effectively limit competition. As a practical matter QPLs are anticompetitive because they restrict the number of participants in procurements before solicitations are even issued. Such lists can thus be viewed to operate as de facto responsibility determinations, or nonresponsibility determinations, as the case may be. [Ref. 9:p. 363] More products are on QPLs than need to be. More resources are needed for effective administration of the program. When used to insure quality control standards, the QPL program is redundant in its efforts. Other manufacturers have commented, "It's not worth it. It's too much of a hassle. You can't open the door. There is too much red tape, too bureaucratic, too complicated." [Ref. 9:p. 355]

Many recommendations were made on how to improve the QPL program, allow for more competition, obtain better quality parts, and lower unit costs. Some of these included: criteria for prequalification standards must be

clarified and made easily available to prospective competitors. Specifications should be more readable and available. Prequalification requirements should be automatically challenged so that they could be employed only in situations where a legitimate need is found. Qualified, independent consultants, who are knowledgeable and experienced, should determine the need for the prequalification of a product, not the OEM. QPLs must not become so encompassing that it includes products that have no critical function in a major system. To meet the dual concerns of providing the products in a timely manner, as well as insuring that the product fully meets the requirement, other procurement techniques can be used, such as preaward surveys, simply technical prequalification reviews, responsibility determinations, and first article testing. Use of QPLs and other quality assurance techniques could then be expressly sanctioned as a means of assuring quality of "genuinely" critical parts. [Ref. 9:p. 82] R. Ludwig adds,

Government should, with its vast and comprehensive resources, be able to evaluate bidders and components without resorting to a QPL. After all, there is no guarantee that a previously qualified supplier will continued to supply high quality parts.

Ludwig specifically recommends a "qualified manufacturer's list"--a list that qualifies a company to make a class of parts or a type of manufacture rather than trying to qualify that supplier to make an individual part. [Ref. 9:p. 85] It was also recommended that the DOD update its data storage

and retrieval system. Such an update, it was estimated, would save the government \$5-6 billion a year in spare parts procurement. [Ref. 9:p. 462]

Lastly, it was brought out that the DOD and industry work together to assure that specifications applied to new major system designs are necessary and cost effective. They should be tailored and not become excessive for the intended applications. Engineering designs should continue to be justified on the basis of a valid life-cycle cost savings or as a response to a safety concern. [Ref. 9:p. 416]

J. CHAPTER SUMMARY

This chapter discussed briefly the history of the QPL program. It covered in some depth two DOD studies concerning the application of the qualification process in government procurements. The chapter also covered Senate hearings concerning the ramifications of the qualification process on a cross-section of small businesses. Some of the more important points brought out by the reports and hearings include:

1. The qualification process is important as an alternative acquisition technique. The major problems stem from an abuse of the program applications. This is a result of either a misunderstanding of qualification goals or a misuse of the process.
2. QPLs must be periodically and thoroughly reviewed by the responsible agency. Many should be revised, updated or eliminated. To help ensure effective management of the program, adequate resources must be made available.

3. The qualification process should be tailored to the wide variation of commodity areas covered by QPLs.
4. The function of the qualification process toward quality assurance is not well defined. Other quality assurance techniques must accompany the qualification testing. However, 100% duplication of testing is considered wasteful.
5. The government must modernize its data storage and retrieval capabilities to effectively administer the QPL program and enhance its effectiveness.
6. Qualified, independent experts should determine the necessity of the qualification process in specifications. Justification for qualification deserves close review.
7. The qualification process should be managed so as not to eliminate competitive bidding for government acquisitions.

As this chapter showed, QPLs have been the focus of much attention, criticism, and debate. As a concept QPLs have a purpose, but it appears that the execution of the program, the resources devoted to the program, and its applications could use improvements. There are many commodity areas the QPLs cover and many perspectives that can be taken toward the program. In the next chapter the current QPL program will be briefly covered, as well as its application to the rapidly advancing technological area of electronics. Current perspectives of the QPL program by electronic contractors and subcontractors will be discussed.

IV. QUALIFIED PRODUCTS LISTS AND THE PROCUREMENT OF SEMICONDUCTORS

A. INTRODUCTION

QPLs cover a wide range of commodity areas. It would take volumes of pages to analyze the application of the QPL process to each commodity area. Instead, this paper will attempt to cover the strengths and weaknesses of the QPL process as it applies to the electronics sector of U.S. industry and in particular the semiconductor area. The semiconductor area was chosen because of the rapid rate of technological advances and the increasing value of the area to military weapon systems. The QPL process as it applies to semiconductors is also the subject of much controversy as to its appropriateness and effectiveness. Details of this controversy will be discussed later in this chapter.

This chapter will first provide some basic definitions of semiconductors. A brief history follows describing the beginnings of government procurement of semiconductors, the Joint Army-Navy (JAN) program, and current policies and problem areas in the acquisition process. Observations and comments of contractors and manufacturers in the semiconductor industry will conclude the chapter. The final chapter will provide an analysis of the QPL process in the semiconductor industry and other commodity areas in general.

Recommendations based on conductor research and interviews will then be provided.

B. DEFINITIONS

The semiconductor industry is the major sub-sector of the electronic components industry producing active components (i.e., components which modify and control electrical signals by amplification, switching action or modulation of the signal in a circuit). Semiconductor devices can be distinguished in terms of their functional breakdown as electronic components. Semiconductors can be either:

1. discrete components: devices composed of a single electronic circuit such as transistors, rectifiers and diodes,
2. integrated circuits: microprocessors, which can be considered as a computer processor on a single chip and memories, which store information in the form of electrical charges, or
3. special purpose devices: devices not categorized in either of the previous two functions. [Ref. 10:Appendix A]

The fastest growing major semiconductor product area is integrated circuits. It is in the integrated circuit market where the greatest efforts are being made in terms of research and development, where the greatest progress has been made in product innovation, and which has had the most significant impact on end-users (i.e., government).

C. BACKGROUND

The first integrated circuits were commercially marketed in 1962. During this time integrated circuit technology was driven by production for military and government end-use products. DOD and NASA procurement during integrated circuits early development offered a constant level of demand for integrated circuits at premium prices. This served to widen the industrial base through which technological innovation in design and production of integrated circuits continued to advance. In 1963 government procurement accounted for 95% of the \$4 million market for integrated circuits and the average selling price of each circuit was \$50. In two years the number of non-government integrated circuit uses expanded with total integrated circuit production reaching \$80 million. Government procurement dropped to 75% of the market. The average integrated circuit selling price had fallen to \$9. [Ref. 10:pp. 12-13]

Government procurement had encouraged and accelerated the pace of technological advancement in the industry. New manufacturers came into existence prompted by the rapidly growing market. From 1965 through 1972 the demand created by a rapidly expanding commercial electronics and computer equipment market propelled technological advancement and market growth in the industry. The commercial market was now the driving force behind innovation and production. By

1972 government purchases had dropped to below 25% of the \$680 million total U.S. production of integrated circuits. From 1972 to 1985 the demand pull from the newly emerging commercial mass markets created a move towards standardized circuit functions. Because of the newly intensified international competition, integrated circuit prices rapidly declined. U.S. manufacturers shifted production processes to cater to the commercial market, producing higher volume, standardized circuits at lower prices. Integrated circuits found new applications in semiconductor memories, consumer products, telecommunications, and in microcomputers. During this period military procurements of semiconductors once again increased and became even more vitally important to U.S. national defense strategy. With the major defense systems building up, semiconductor sales to the government grew from \$247 million in 1975 to an estimated \$1.3 billion in 1985 [Ref. 10:p. 18]. Despite the fact that the commercial sector of the business remained the driving force for product application, military sales of semiconductors was growing rapidly enough and steadily enough so that by 1985 U.S. companies were again giving military sales serious attention. To signify the importance of semiconductors in major military defense systems, the Electronic Industries Association predicts that semiconductor sales for government end-use applications will increase to \$3.1 billion in 1980 from \$1.16 billion in 1984. Over this same period the

electronics portion of the defense budget will increase by 3.2%. [Ref. 10:p. vii]

Semiconductor products play a vital role in the U.S. national defense and will likely play an even greater role in the future. Before the comments of semiconductor manufacturers and contractors are discussed, the current acquisition regulations will be introduced.

D. ACQUISITION POLICY AND PROCEDURES

During the birth of the semiconductor industry, the military and other government agencies were the driving forces behind its technological innovations and applications. To guard against defective semiconductor products in government end-use items, the government and the semiconductor producers introduced a system of testing and production requirements; this was considered a sensible approach to quality assurance.

During the late 1960's, as volume production became possible, a new revision to U.S. government semiconductor procurement requirements took place. In 1969 this revision created a new government Qualified Parts List, the Joint Army-Navy (JAN) system. This system was created to encourage the production of higher volumes of products for government end-use applications. With the creation of the JAN system, additional testing and production requirements were deemed necessary to insure an acceptable level of quality control. The general Mil-M-38510 specification,

also known as the JAN system, is made up of a general specification and a series of detailed drawings called "slash sheets." Mil-M-38150 identifies all design, materials, finish, tests, and qualification requirements for integrated circuits. Any part sold with a JAN marking must meet over 150 pages of requirements. Specific requirements of the slash sheets typically contain 30 to 40 pages of performance specifications. [Ref. 10:Appendix B]

Semiconductor devices used in military applications can also be purchased through three other DOD-approved specification systems. They include:

1. Mil-STD-883C: basically an encyclopedia of test and inspection methods to be used on integrated circuits supplied to the government. It also defines the screening and quality conformance test flows for integrated circuits.
2. Defense Electronic Supply Center (DESC) Drawings: a drawing system that is not as rigid as the JAN system but attempts to provide a standardization mechanism for description of part performance and screening requirements. DESC, responsible for the qualification and administration of the JAN qualified parts lists, created this drawing system in response to the declining usage of JAN-QPL listed products.
3. Source Control Drawings (SCDs): a custom-tailored description of a commercially purchased part. These include the contractor's own set of processing procedures and test parameters, as long as they satisfy certain minimum requirements. SCDs allow contractors or subcontractors to retain parts control, to design with the latest technologies and to meet cost objectives. However, SCDs tend to lead to a proliferation of different part types.

Generally, contractors must look first to the QPL lists for military integrated circuit needs before resorting to other specifications, such as DESC drawings or their own

source control documents. The use of SCDs rather than JAN parts greatly increases the number of part types a semiconductor manufacturer must process for contractors. DESC estimates the number of national stock numbers for semiconductor devices is now in the vicinity of 80,000, while the number of integrated circuit designs that exist in the commercial market is only around 5,000. [Ref. 11:p. 66]

Now that a brief introduction to the history of semiconductor procurement has been covered, as well as DOD-approved procurement systems for semiconductors, problems in the current acquisition system will be addressed from the semiconductor industry's perspective. In October of 1985 the Semiconductor Industry Association (SIA) prepared its White Paper to the DOD. It addresses government procurement of semiconductors. Some of the problem areas addressed in that paper follow.

E. ISSUES CONCERNING GOVERNMENT ACQUISITION OF SEMICONDUCTORS

These are some of the problems brought out by the SIA in its white paper concerning government procurement of semiconductors.

1. Semiconductor manufacturers do not have adequate representation in developing semiconductor procurement regulations and policies. They are too far removed from government contracting representatives.
2. Government continues to procure semiconductors with a policy that results in devices of the same quality and reliability as commercial products, but at a higher cost.

3. Present procurement procedures result in nonstandard products, low volume lot sizes, massive volumes of inspection and testing data requirements, and utilization of "sunset technologies." "Sunset technology" is technology that is past its mature growth phase, bordering on obsolescence.
4. The present government procurement system encourages semiconductor users to build into their government systems a wide range of different part types, thus increasing specification documentation as well as costs.
5. Standardization requirements emphasize inspecting for quality rather than designing in quality.
6. Major defense systems are designed for operational lives of up to 30 years resulting in extended semiconductor life cycles. This could result in continued use of obsolete technology and extremely high replacement costs.
7. Current government inspection and testing requirements have become inappropriate and near impossible with the advancement of integrated circuit technology.
8. Expensive and obsolete integrated circuit packages are still required by government specifications.
9. The JAN program and other government semiconductor procurement programs are highly resistant to change and advances in technology. In order for the government to obtain the latest technology, achieve the highest quality and reliability at the best price, government procurement policies must adjust to the changing technology in both the product and the manufacturing process.

F. SEMICONDUCTOR SUPPLIERS' AND CONTRACTORS' COMMENTS

In order to obtain current views of the JAN and other government semiconductor procurement policies, interviews were conducted with representative semiconductor manufacturers and contractors. Appendix A lists the questions asked and about which the interviews centered. The following paragraphs are a compilation of the results of the inter-

views. Most of the discussion centered on the JAN-QPL procurement system; however, other policies naturally entered the conversation. There was unanimous agreement that the JAN-QPL system should be retained, however, changes are needed. Some of the changes mentioned during the interviews are contained in the following paragraphs.

1. Procedures should be devised to provide an incentive for contractors to design in JAN products into their systems. As the system stands now, specifications can be developed to accommodate only unique semiconductor devices.
2. Qualification and testing procedures for new semiconductor devices is very expensive and time consuming for suppliers and time consuming. The JAN-QPL system does not lend itself to qualification of technologically advanced semiconductor devices. The qualification process usually takes approximately two years. By that time commercial production of the device is in its declining stage and the volume produced is greatly reduced. Figure 1 illustrates this point. DESC needs

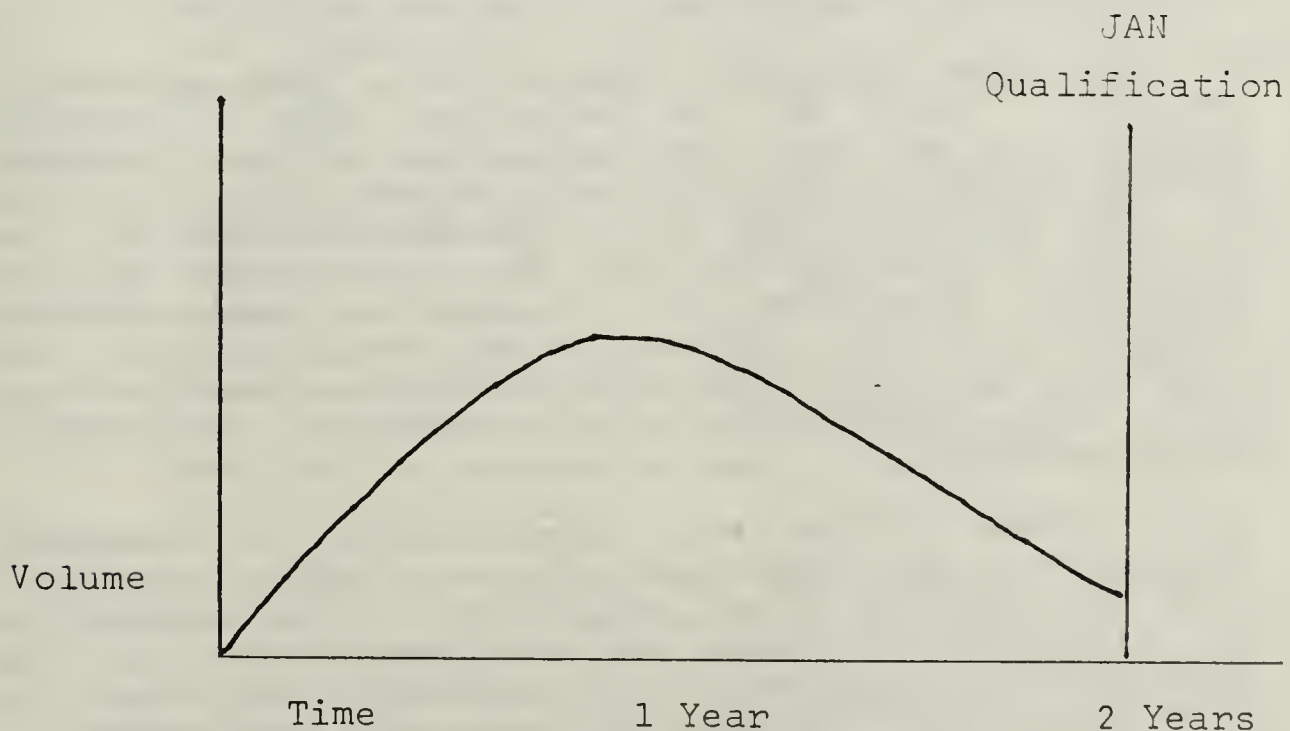


Figure 1. Growth Phase of Typical Semiconductor Device

to guarantee a specified turnaround period for product qualification to help eliminate this situation. As the program now operates, it slows down the introduction of new technology. When improvements of a JAN-QPL device are developed, the device must be requalified as if it had never been qualified. This requalification consumes additional costs, time and energy.

3. Once JAN qualified, there is no guarantee of future procurements by the government or usage by contractors. Therefore, with the uncertainty of purchases, suppliers have little or no incentive to qualify their devices.
4. With the advancement of technology and development of more advanced integrated circuits, current JAN testing and inspection procedures will no longer apply. When integrated circuit assembly is totally automated, current inspection procedures will actually be detrimental to the reliability of the device.
5. Current rescreening procedures conducted by contractors on incoming shipments are not cost-effective, except in rare instances (i.e., space systems), and in the words of one supplier are a "travesty." Care must be taken that test correlation differences do not exist when devices are rescreened. Feedback to the supplier on rescreening results are a necessity for future corrective action.
6. JAN-QPL semiconductor devices do not guarantee quality. There are no historical data to compare reliability of JAN devices with devices procured through the other DOD approved systems. If a function of JAN qualification is to assure reliability, as implied in DOD Manual 4120.3M, then other quality assurance techniques are necessary. Semiconductor suppliers agreed that military specifications are necessary for high technology devices, specifications that are appropriate for required performance characteristics.
7. More direct contact and communication is necessary between Rome Air Development Center (RADC), the custodian of MIL-M-38510 and MIL-STD-883C, the contractor or subcontractor designing the component, and the semiconductor supplier. This dialogue could lead to more utilization of standardized parts and state-of-the-art semiconductor devices. Semiconductor specifications should be created with the advice of semiconductor suppliers.

8. JAN-QPL semiconductor devices are substantially higher in cost than commercial parts for the following reasons:
- a. JAN devices are produced in small uneconomic lot sizes, resulting in many product types.
 - b. Specifications and inspecting requirements are not compatible with automation production.
 - c. JAN devices must be manufactured in the United States or a few designated NATO countries, resulting in much higher labor costs.
 - d. The costs of maintaining data concerning device traceability, inspection and testing results are added to the cost of the product.
 - e. The cost of capital investments, initial testing and qualification of the product is amortized over production of the product. One semiconductor supplier estimated his company invested \$40 million in capital facilities to compete in JAN-QPLs. Another supplier stated the average cost for testing and qualification of a single device is \$50,000.
 - f. The required usage of obsolete and expensive integrated circuit packaging adds to the cost. One supplier estimated 30% of the military applications of integrated circuits could utilize plastic packaging vice the more expensive ceramic.

The estimates of price difference between JAN-QPL devices and comparable commercial products varied from four times the cost to almost 25 times the cost for a one-of-a-kind 'S' (space level), qualified part. JAN-QPL devices available from only one source are estimated to be almost twice the cost of competitively procured JAN products. One semiconductor supplier commented, "We end up selling the paperwork and giving away the product." The more data required, the higher the cost.

9. DESC needs to administer the JAN-QPL program more effectively. Contractors have no idea who is coming up for JAN qualification. It was recommended DESC publish a periodic, updated notice of JAN-QPLs and qualified manufacturers. This notice should include the status of manufacturers currently undergoing qualification. It was also felt DESC needs to update its data storage and retrieval capability and that the

DOD needs to commit more resources to the administration of the JAN-QPL program.

10. There was general agreement that the JAN-QPL program creates an economic barrier for businesses attempting to compete for QPL contracts. The qualification and testing of products is expensive. The required documents on testing and inspection data are enormous in volume. The reporting requirements to maintain qualification was cited as "overwhelming." One semiconductor supplier recently dropped 35 of its 135 JAN-QPL products, because none were sold. Little incentive to quality exists if there is no demand.
11. Utilization of a JAN-QPL does not guarantee delivery of product in a timely manner. Low volume QPL devices still require long lead times for delivery due to infrequent demands.

One contractor, Lockheed, has established a "monitored line program" of QPL-type semiconductor devices. The monitored line program (MLP) was developed because not all specifications were covered by QPLs. In 1972 the Air Force contracted with Lockheed to establish and administer the MLP to insure a constant source of high quality, reliable semiconductor devices. Lockheed supplies these parts to over 40 subcontractors and other aerospace industries. The reliability rate and delivery record of these parts is unequalled. To date there have been no failures of these parts in operation [Ref. 12]. Lockheed maintains qualified engineers at the suppliers' manufacturing sites to constantly monitor the processes and inspect the products. The MLP seems to work for their low volume, high reliability requirements. However, the Lockheed representatives interviewed did state that QPLs are first choice when they meet all specification requirements.

This chapter provided an insight to the complexity of the semiconductor procurement systems and the limitations of the JAN-QPL procurement process in this rapidly advancing technological sector. Based on research and interviews conducted, recommendations for improvement of the JAN-QPL procurement process and the QPL procurement process in general will be given in the next chapter.

V. ANALYSES AND RECOMMENDATIONS

A. INTRODUCTION

This chapter will provide a conceptual analysis of the government's acquisition process. Next, the QPL program will be discussed within the context of the government's acquisition objectives. An analysis of QPL procedures and policies will be given along with recommended applications of QPLs. Some variations of purchasing procedures are introduced for comparison purposes. Specific recommendations directed toward the JAN-QPL system for the procurement of semiconductors will also be included, followed by the conclusions of the study.

B. GOVERNMENT ACQUISITION PROCESS

In any government acquisition there always exist tradeoffs that must be made: quantity versus quality, high technology versus reliability/maintainability, schedule versus test/evaluation, etc. In making an acquisition the government must consider cost with regard to a variety of factors, such as delivery schedule, reliability, quality, maintainability, interchangeability (standardization), performance (specifications), life cycle, expansion of industrial base, and political realities (source selection, competition and small business considerations). To best achieve an optimum combination of these factors at a

favorable price, the procuring agencies have a multitude of contracting mechanisms at their disposal. One such contract mechanism is prequalification, where higher procurement cost is traded for expected higher quality and prompt delivery.

The QPL was first established for specific products because: 1) "the time required for testing in connection with production would unduly delay delivery of the supplies being purchased." 2) Either the costs of repetitive testing would be excessive or testing would require special equipment not commonly available. 3) The government required assurance, prior toward, that the product was "satisfactory for its intended use" [Ref. 6:p. 4]. During the 1970's the third justification for a QPL was changed to read, "it (the QPL) covers life survival or emergency life saving equipment." In 1985 a fourth justification was added which stated a QPL could be established if, "the application is critical; failure of the part or equipment would jeopardize successful completion of the mission or pose a significant risk to life or property" [Ref. 3:p. 4-4]. Thus the objectives of QPLs went from prompt delivery and satisfactory performance to prompt delivery and critical importance. But what results do QPLs actually achieve? When should QPLs be applied? And what changes to the QPL program can be made to more effectively obtain stated objectives and still keep the program cost effective?

C. QPL ANALYSIS

To begin the analysis of QPLs the following question will be discussed: What results do QPLs actually achieve?

QPLs provide an incentive for vendors to become qualified. In private business, it is common practice to narrow down the supplier base. This is accomplished to provide incentive to the vendors to become the major supplier for a consistent buyer. QPLs in effect do this by defining an entry barrier to prospective vendors. If a vendor goes through the qualification process he is saying in fact, that he is serious about manufacturing the product. The vendor is making an investment, based on a reasonable assurance that future acquisitions will be made and will be profitable. Once qualified the vendor has greater bargaining power in setting price. Ideally, from the government's standpoint, there should be more than one qualified vendor. If not, that vendor has in essence a monopoly and the government will probably pay a premium price for any qualified product procurements. If there is more than one qualified source, prices may approximate competitive outcomes, while quality and service should improve.

QPLs can eliminate undue delay in the acquisition process. In certain cases where time is the requirement in specified conformance tests (i.e., storage, aging, endurance, etc.), QPLs can be justified in eliminating delays in procurement. When extensive or complex

conformance testing or special equipment, not normally available, is necessary for verification of product conformance, qualification testing can also be justified to ensure subsequent timely product delivery. Another requisite for qualification involves the presence of a high correlation between conformance test outcomes and manufacturing operating characteristics, characteristics known and observable only by the manufacturer. Qualification is required because destructive tests are necessary for the government to ensure the integrity of the manufacturing process and thus conformance of the product to specifications. Without qualification in these cases, normal post-production conformance tests would be unrealistic in the procurement environment. However, QPLs do not eliminate delay when, after an extended period of time after specification issuance, there are no qualified sources. QPLs can not be justified if the qualification testing is 100% repeated during specification conformance testing during production. If production lead time is greater than the time required for qualification testing, qualification could be eliminated with all required examination performed during production. When qualification procedures have been waived to secure "qualified" vendors, the qualification requirement should be reviewed for justification.

QPLs provide some measure of quality assurance. It has been brought out in the QPL studies and it is stated in the

QPL directives that, "the listing of a product on the QPL signifies only that, at the time of examination and test, the manufacturer could make a product . . . that meets the specification requirements" [Ref. 3:p. 4-2]. The 1968 DOD QPL report asked the rhetorical question, "Does . . . this one time manufacture, sometimes hand-made, assure quality in production? Obviously not" [Ref. 6:p. 8]. However, justification for qualification has shifted over the past ten years to include "life survival/emergency life-saving equipment" and "critical" parts. These justifications surely show concerns toward quality products. The 1980 DOD QPL study recommended QPLs be justified only for requirements not critical in terms of mission or safety [Ref. 8:p. 4]. The implication of qualification and QPLs on product quality assurance is an area of misinterpretation and controversy.

Justification for prequalification because an item is "life-saving" or "critical" to mission, should not be an item's sole justification. Destructive testing of an item during the prequalification testing can provide some indication of its quality. However, other quality assurance technologies should be administered in addition to prequalification for these critical items. Appropriate measures, such as statistical testing, monitoring, quality audits, source inspections, etc., help insure quality is maintained throughout the production cycle. Effective

feedback mechanisms must also be established to resolve problems and correct discrepancies. Supplier performance data should be maintained including defective rates, quality audit results, and delivery performance, to be used to determine future procurement decisions.

QPLs also have an indirect effect on quality assurance. Once qualified, a vendor desires to maintain his qualification for future procurements. If a vendor were subsequently taken off the qualification list, it could have far-reaching ramifications. This could include unwanted publicity, loss of future contracts and resultant diminished return on his investment.

QPLs ensure continuous availability of the product. As long as the product is actively procured, the vendor will manufacture it. The vendor has already made the investment and it would make poor business sense not to maintain qualification. One semiconductor supplier stated that his company invested \$40 million to manufacture qualified products for the government. They are determined to continue manufacturing qualified products and "do the job right," as long as a market exists [Ref. 13].

QPLs can promote product standardization. QPLs cannot be expected to directly reduce proliferation of parts in the DOD inventory. But, QPLs can increase standardization if the specifications emphasize performance and interface standards rather than component/design standards.

QPLs can inhibit product innovation. Whenever a qualified product's design, performance, or manufacturing process is changed, even improved, the entire qualification process must be repeated. Considering all the money, time, and paperwork necessary for qualification, manufacturers may feel it is not worth the effort and continue manufacturing as previously qualified.

QPLs can limit competition for direct government procurements. As discussed in earlier chapters QPLs do provide an economic barrier in bidding for contracts involving qualified products, although recent changes to the program have alleviated this barrier somewhat for small business. Subcontractors who have continuously provided qualified products for contractors, but have not previously qualified, cannot be considered for bids when spare products on a QPL are procured directly by the government. This situation should be corrected; but care must be taken so as to be fair to suppliers previously qualified.

D. APPLICATION OF QPLS

As a general guideline QPLs will be most effective in the following situations:

1. acquisitions for large quantities of similar items with relatively low unit cost,
2. acquisitions for items in a mature technology stage,
3. acquisitions for items expected to be procured repetitively,

4. acquisitions for items that could lend themselves to multiple applications.

QPLs have been found to be less effective for the following type acquisitions:

1. Acquisitions for complex items in an immature technology stage. At this technology stage qualification tests may not be standard, potential qualified sources may be extremely limited, or specification requirements are changing too rapidly. A QPL at this point would severely restrict innovation in product improvement.
2. Acquisitions for low volume items. It has been difficult to obtain qualified sources for low volume procurements. The incentive for prospective vendors is not there for an investment of their resources. Under these conditions first article testing and other methods of assuring necessary demonstration of requirements would allow better flexibility in matching costs and risks [Ref. 8:p. 15]. If the QPL process was applied in this situation, the government could expect to pay a premium price for the product.

E. ACQUISITION VARIATIONS OF QPLS

The following acquisition programs are discussed to point out timely procurement techniques that attempt to achieve quality and timely delivery of parts.

1. Qualified Manufacturers Lists

The Qualified Manufacturers List (QML) is similar to the QPLs in its objectives. Its pilot test program is currently being conducted on the general MIL-M-38510 specification. Instead of discrete products being qualified, an entire line or family of products will be qualified. Defense Electronic Supply Center (DESC), representatives visit manufacturing facilities to conduct detailed surveys. Survey requirements include production

inspection systems, quality and reliability assurance programs, test facilities, production facilities, and line certifications. Verification that the manufacturer has an effective self-audit program also is included. This process should be more effective in several commodity areas, such as the rapidly advancing technology area of semiconductors, and also in areas of similar types of manufacturing, such as the tooling and machining industries. If effective, QMLs should increase competition and reduce costs. Product quality needs to be closely monitored if a large supplier base is established. QMLs would be effective as a buyer's guide for both prime contractors and direct government procurements. A supplier rating system should be used to narrow supplier base and provide incentive for supplier performance.

2. Monitored Product Line

Contractors have also developed parallel systems similar to QPLs and QMLs to satisfy their component and parts requirements. In the previous chapter, Lockheed's Monitored Product Line was discussed. The effectiveness of these systems is impressive. However, contractors should still be directed to purchase QPLs or from QMLs first, if those products meet their requirements. Monitored Product Line should still remain a supplement to QPLs and/or QMLs.

3. Chrysler's Purchasing Program

An example of commercial buying techniques is Chrysler's procedures for purchasing integrated circuits for

their automobiles. Chrysler insures quality as a standard feature in their integrated circuits by the following procedures. The company:

- a. conducts an in-depth yearly analysis of supplier quality performance and holds periodic meetings with suppliers during the year.
- b. requires suppliers to qualify each component separately. Chrysler will not approve a vendor's complete product line at once.
- c. requires vendors to have statistical process control programs.
- d. develops long term contracts that are not rebid unless there is a problem. However, Chrysler does retest the market yearly to ensure competitive prices are offered.
- e. has initiated a vendor rating system to determine future buying decisions. The concept is to give the best suppliers more business and eliminate poor performers. The rating system is based on price, delivery, technology assistance and quality. Quality rating is determined by defect rates, results of quality audits of suppliers' manufacturing process and controls, electrical performance of component samples, and responsiveness of suppliers to quality problems.
- f. requires all integrated circuit suppliers to license a second source, to ensure continuous availability of product. Current defect level is .0015 or 1500 parts per million for components received. [Ref. 14:pp. 62!13-17]

This purchasing program is similar to QPLs but covers a much more restricted variety of products. Some concepts are found in these techniques that are also found in the QPL program. These include separate qualification for each component, inspection of suppliers' manufacturing facilities, incentive for suppliers to perform well, narrow supplier base, and establishment of continuous availability

of parts through second sources. The supplier rating concept that Chrysler has established to provide feedback to suppliers on problem areas, needs further development for application in government acquisitions.

Having covered general applications of QPLs, specific recommendations will be made directed at the JAN-QPL system of semiconductor procurement.

F. JAN-QPL SYSTEM RECOMMENDATIONS

The following recommendations are based on conducted research and interviews with representatives of the semiconductor industry, and if properly implemented should result in obtaining advanced and reliable semiconductors at the lowest cost.

1. Implementation of the QML process in this commodity area should increase efficiency and reduce the cost of procurement. This system should also provide incentive for product innovation and reduce the time to operational application.
2. Implementation of the Military Drawing System combined with the elimination of Source Control Drawings should increase standardization in semiconductor applications. With greater standardization, volume production might be possible, thus permitting usage of the best quality control techniques available and reducing their unit cost.
3. Procedures should be developed to provide incentives for contractors to design JAN or Military Drawings components into their systems.
4. Specification conformance testing requirements must be revised as technology advances and automated manufacturing processes become commonplace. As the technology continues to advance, rescreening procedures and quality assurance methods must also adapt to the changing processes. Standards and specifications

should also reflect the new technology and represent realistic operational requirements.

5. Currently, military and space systems incorporate semiconductors that may have operational lives of thirty years or more. The government has a need to procure semiconductors as replacement parts for those systems long after the part has ceased to be produced for commercial usage. Therefore, replacement parts costs are extremely high. Perhaps preplanned semiconductor product improvement could be used. It would reduce technical risk during initial procurement and allow for future utilization of state-of-the-art technology, thus increasing effectiveness and operational life of the system. It would reduce reliance on obsolete technology and in the long term reduce support costs.
6. To help implement better future procurement strategies, the U.S. government, the U.S. semiconductor industry, and U.S. manufacturers of government end-use systems which utilize semiconductors should form a board to establish policies and objectives for improvement of the current procurement system. [Ref. 10:p. vii]
7. Because of the increasing importance of semiconductors in major defense systems, the government must provide incentives for U.S. manufacturers to maintain onshore manufacturing capability. All individuals interviewed agreed, that once U.S. manufacturers located offshore, the U.S. would have no capability to produce semiconductors in a serious national emergency. The government should provide incentive to motivate the industry to invest beyond efforts required to meet normal contractual obligations. This motivation could include government paying the costs for product or manufacturer qualification; or, as mentioned in a recent Wall Street Journal article, provide funds for a multifirm laboratory research center [Ref. 15:p. 1]. As the government pursues more effective procurement procedures, it should strive to establish a basis for a partnership. The current procurement policy does not address this issue.

G. CLOSING RECOMMENDATIONS AND CONCLUSIONS

Many of the recommendations mentioned in past studies still need to be addressed. It is assumed that resource

problems cause many of the difficulties and limitations previously noted in the operation of the system. However, with the Congressional, business community, and public attention the QPL program is receiving, it appears that further revision of the program is in the near future. The QML program is a good start. As it is with most programs, the application of the process will determine its effectiveness. Some closing recommendations include:

1. All QPLs should be reviewed for appropriateness. Many can be eliminated.
2. Future use of QPLs should be strictly reviewed by independent experts.
3. Increased resources should be devoted to the administration of the program.
4. Management data should be developed, reviewed, and analyzed, for future program direction and policies.
5. Periodic review requirements on the need for existing QPLs should be strengthened.

As the program now operates, the decision of vendor prequalification should be chosen only when short delivery dates require it, or expensive time-consuming tests are involved in conformance testing. QPLs are a means to an end and tradeoffs in costs, quality and schedule must be expected. The decision to prequalify must be applied on an item by item basis, and not solely because the general specification is prequalified. It is not cost-effective and severely restricts competition and innovation. Prequalification should be an economic procurement decision. When

prequalification is applied premium prices will be paid, especially for sole source products.

In the long term prequalification will be less costly when the administrative requirements are reduced. As a means to that objective, data repositories need to be automated to improve the acquisition, storage, update and retrieval of procurement and technical data. Compatible computer data bases within the government would be required. With such a system, Military Drawings and specifications could be continuously updated and allow for rapid transmission throughout the U.S. Widespread availability of technical data and drawings would be instrumental in increasing competition, achieving greater procurement effectiveness, and increasing standardization and cost reduction.

APPENDIX

INTERVIEW QUESTIONS FOR CONTRACTORS AND SUPPLIERS

1. Quotation from Defense Electronics, February 1986: "The military uses yesterday's technology today while the commercial industry uses tomorrow's technology today." Do you agree with that statement?
2. Do you agree with the statement, "There is a lack of standardization in military specifications?" Does it prevent the volume automation necessary for statistic quality control (SQC) methods, thus resulting in higher prices for the same quality? Why?
3. Could you explain the quotation, "procurement procedures are centered on testing for quality rather than on designing in quality?" Do you agree?
4. What quality control methods do you employ or does the government direct you to employ, for QPLs (i.e., 100% rescreen, 100% device testing at each major step of fabrication)? Does it shorten product life? Does the government ever inspect plant/processes? Conduct quality audits?
5. What is the difference in your cost between a QPL and commercial product which is for all intents and purposes the same specifications?
6. Are any warranties offered with QPLs?
7. There's a debate between limiting Mil-Spec manufacturing in favor of standard commercial parts. How do you feel? If commercial products were procured, do you foresee any economic costs to American industry? Do you see an advantage in second sourcing electronic components?
8. Do you think QPLs are successful in reducing delivery delays as they are designed to do?
9. What types of contracts are used for QPLs? Cost plus, fixed, etc.?
10. There is a time lag from innovation to utilization through QPL program in military applications, contrasted with commercial applications. How do the time periods compare?

11. Is being on a QPL worth the effort (hassles, paperwork, testing procedures, inspections, etc.)? Is it cost effective? What is your motivation to be on the list?
12. Who pays for the QPL testing? Do you get a payback on investment costs, time, effort? Do you have any financial data available (i.e., QPL sales % total sales, profit margin, ROI, administrative overhead costs, dollar amount of annual sales)? Any large financial costs involved?
13. Do you know if you are single source or multiple source for your QPLs? Does that affect price? Are you aware of competition/other sources for QPLs?
14. Do you ever sell the same part to private company as to government without certification?
15. How does your company ensure quality in parts you purchase or subcontract out? Emulate QPL procedures for your purchases? If QPLs are purchased, does the liability stay with the manufacturer, even if that product is used in your component? Do you pass on the QPL cost to the end user?
16. What type of recertification procedures are used for QPLs that you manufacture?
17. Do you think QPLs hinder small businesses from competing for QPL government contracts? Are QPLs entry barriers?
18. Any personal experiences with QPLs that might help this research? Have the procedures changed recently resulting in better effectiveness? Are there any intermittent evaluations conducted on products validating the necessity of the QPL program? Should QPLs be discontinued after a certain period of success with product/process?

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